Original Article

Ottawa Ankle Rules and Subjective Surgeon Perception to Evaluate Radiograph Necessity Following Foot and Ankle Sprain

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Abstract

Background: Foot and ankle injuries are frequent in emergency departments. Although only a few patients with foot and ankle sprain present fractures and the fracture patterns are almost always simple, lack of fracture diagnosis can lead to poor functional outcomes. **Aim:** The present study aims to evaluate the reliability of the Ottawa ankle rules and the orthopedic surgeon subjective perception to assess foot and ankle fractures after sprains. **Subjects and Methods:** A cross-sectional study was conducted from July 2012 to December 2012. Ethical approval was granted. Two hundred seventy-four adult patients admitted to the emergency department with foot and/or ankle sprain were evaluated by an orthopedic surgeon who completed a questionnaire prior to radiographic assessment. The Ottawa ankle rules and subjective perception of foot and/or ankle fractures were evaluated on the questionnaire. **Results:** Thirteen percent (36/274) patients presented fracture. Orthopedic surgeon subjective analysis showed 55.6% sensitivity, 90.1% specificity, 46.5% positive predictive value and 92.9% negative predictive value. The general orthopedic surgeon opinion accuracy was 85.4%. The Ottawa ankle rules presented 97.2% sensitivity, 7.8% specificity, 13.9% positive predictive value, 95% negative predictive value and 19.9% accuracy respectively. Weight-bearing inability was the Ottawa ankle rule item that presented the highest reliability, 69.4% sensitivity, 61.6% specificity, 63.1% accuracy, 21.9% positive predictive value and 93% negative predictive value respectively. **Conclusion:** The Ottawa ankle rules showed high reliability for deciding when to take radiographs in foot and/or ankle sprains. Weight-bearing inability was the most important isolated item to predict fracture presence. Orthopedic surgeon subjective analysis to predict fracture possibility showed a high specificity rate, representing a confident method to exclude unnecessary radiographic exams.

Keywords: Ankle, Ankle fractures, Ankle injuries, Foot, Fractures

Introduction

Ankle ligament injuries represent 14-21% of total sport lesions. Nearly 18% of patients present an associated foot and/or ankle fracture.[1,2]

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Although approximately 85% of patients following foot and/or ankle sprain present no fractures, most orthopedic surgeons request radiographs for all patients to prevent misdiagnosis of simple sprain when the patient presents fracture.[3]

A study by Stiell *et al*.[4] proposed the Ottawa ankle rules to decrease radiation exposure and unnecessary expenses in patients complaining of foot and/or ankle sprain.

Several studies validated the Ottawa ankle rules as an effective tool to safety decrease the number of radiographic exams in foot and/or ankle injuries to 28-40%.[5-17]

In several countries however, the Ottawa ankle rules are unfamiliar to orthopedic surgeons and only the subjective perception of fracture is used to define the necessity of X-ray.

The authors hypothesize that the Ottawa ankle rules and the subjective surgeon perception should be complementary to prevent unnecessary radiographic exams.

Subjects and Methods

A cross-sectional study was performed in a general hospital from July 2012 to December 2012 to evaluate the Ottawa ankle rules reliability and subjective orthopedic surgeon perception of fractures following foot and/or ankle sprain.

Ethical approval was granted by the local Ethics Committee (CAAE:19491813.7.0000.5125) and informed written consent was obtained from all patients.

Inclusion criteria involved adult patients (>17 years old) presenting foot and/or ankle sprain admitted to the emergency department. Exclusion criteria involved polytrauma, patients unable to answer the Ottawa questionnaire, and those who refused to perform the X-ray to evaluate fracture possibility.

A total of 274 patients were assessed with foot and/or ankle sprain. Average age was 37.4, ranging from 18 to 88 years old. Women represented 59.1% and men 40.9%. Inversion was the injury mechanism in 83.6%, eversion in 7.7% and other non-specific mechanisms in 3.6%.

The orthopedic surgeon responsible for patient care answered a questionnaire containing information related to the Ottawa ankle rules. Perception based on subjective feeling for fracture possibility was determined prior to X-ray evaluation.

Figure 1 shows the Ottawa rules.

All patients were submitted to the radiographic exam to confirm fracture possibility. Anteroposterior, oblique and lateral foot views as well as anteroposterior and lateral ankle views were taken.

Statistical analysis

Kappa index was utilized to assess agreement between orthopedic surgeon opinion and fracture presence. McNemar test evaluated if the surgeon disagreement was random. Sensibility, specificity, positive and negative predictive values, and accuracy of Ottawa ankle rules were also verified.

Results

Thirteen percent (36/274) of patients following foot/ankle sprain presented fractures. Ankle fractures were present in 64.6% (23/36). Fifty-seven percent (13/23) presented Weber B and 43% (10/23) Weber A. Foot fractures were found in 15.7% (6/36). Eighty-three percent (5/6) presented fifth metatarsal fractures and 16.7% (1/6) cuboid fracture. Foot plus ankle fractures were present in 19.7% (7/36).

Orthopedic surgeon subjective analysis concerning fracture occurrence showed 55.6% sensitivity, 90.1% specificity, 46.5% positive predictive value and 92.9% negative predictive value. The general orthopedic surgeon opinion accuracy was 85.4%. The Ottawa ankle rules presented 97.2% sensitivity, 7.8% specificity, 13.9% positive predictive value, 95% negative predictive value and 19.9% accuracy respectively. Weight-bearing inability was the Ottawa ankle rules item

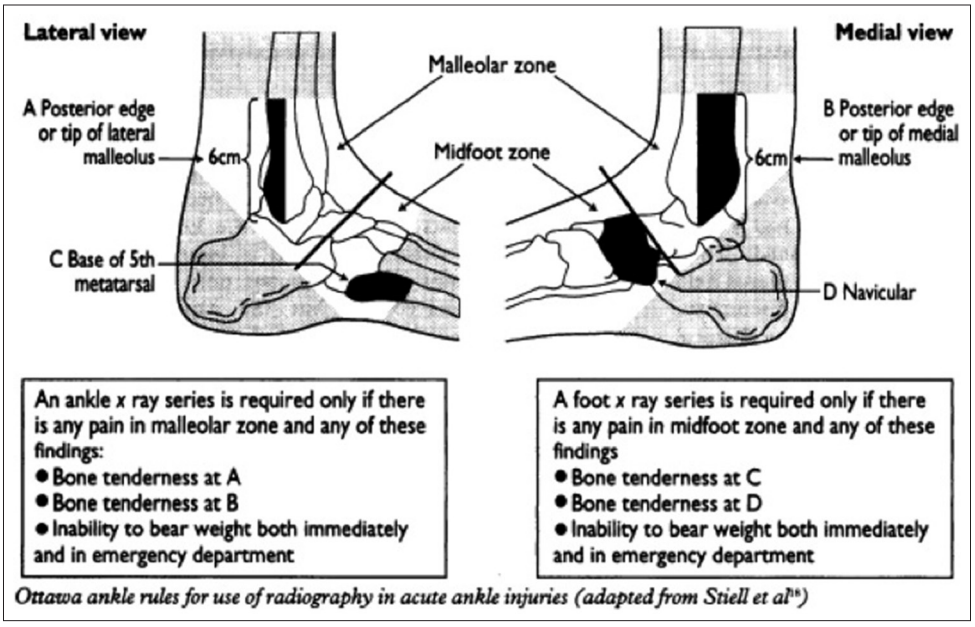


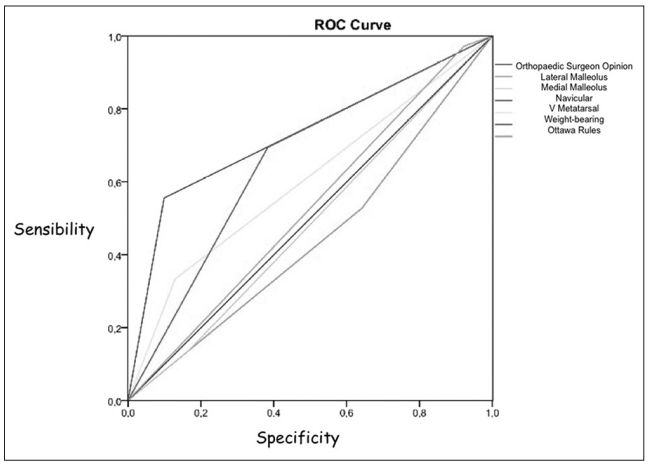
Figure 1: Ottawa ankle rules for foot/ankle injuries

Table 1: Sensibility, specificity, positive and negative predictive values and accuracy of an orthopedic surgeon opinion and Ottawa ankle rules both generally and in each separate item

Evaluation	Sensitivity %	Specificity %	Positive Predictive Value %	Negative Predictive Value %	General Accuracy %
Subjective Perception	55.6	90.1	46.5	92.9	85.4
Ottawa Rules in General	97.2	7.8	13.9	95	19.9
Weight-bearing Inability	69.4	61.6	21.9	93	63.1
Lateral Malleolar Pain	52.8	35.8	11.2	83.2	38
Medial Malleolar Pain	13.9	83.2	11.4	86.3	86.1
Navicular Pain	11.1	88.8	13.3	86.7	78.6
Fifth Metatarsal Pain	33.3	87.1	28.6	89.5	80.1

presenting the highest reliability (69.4% sensitivity, 61.6% specificity, 63.1% accuracy, positive predictive value 21.9% and negative predictive value 93% respectively), as shown in Table 1.

Applying receiver operating characteristic (ROC) curve to correlate sensibility with the specificity complement, only subjective surgeon opinion and weight-bearing presented a $P < 0.05$. This analysis concludes that other Ottawa ankle rules items analyzed separately show no statistical significance. Graph 1 shows the ROC curve of the Ottawa ankle rules.



Graph 1: Sensitivity, specificity and receiver operating characteristic curve of Ottawa ankle rule items and subjective perception of the orthopedic surgeon concerning fracture occurrence

Discussion

The Ottawa ankle rules represent an important instrument to safely predict fracture possibility due to high sensitivity presented in several studies.[1-16]

The authors of this study found 36 fractures (13.1%) in a total of 274 foot/ankle sprains.

Bachman *et al*. showed that between 28% and 40% of X-rays can be prevented applying the Ottawa ankle rules for ankle sprains.[17]

However, the present study showed low specificity and proved to be inefficient to singly avoid unnecessary radiographs following foot and/or ankle sprains.

In numerous countries, the Ottawa ankle rules are underused. Surgeons sometimes prefer taking X-rays of all patients to prevent legal consequences. Otherwise, the Ottawa ankle rules are unfamiliar to orthopedic surgeons in several countries and only surgeon evaluation based on clinical examination determines exam necessity.

The current study presented subjective fracture perception as a statistically confident method complementing the Ottawa ankle rules to prevent additional costs and radiation. Nearly 90% specificity pointedly confirmed surgeon subjective evaluation as a complementary and valuable tool in the clinical diagnosis arsenal.

As strengths, this study presented a significant sample size, 274 patients and emphasized the Ottawa ankle rules as a safe and effective tool when positive to indicate radiographs. The authors found weight-bearing inability as the most important Ottawa ankle rule item to predict fracture possibility. The authors are unaware of previous studies showing subjective perception as a valuable method to prevent unnecessary radiographic exams. In addition, the authors showed that lateral malleolus, fifth metatarsal, and cuboid must be carefully evaluated in the clinical and radiographic exams to prevent misdiagnoses.

As weakness, surgeon experience influence on responses was absent in this study. The authors hypothesized clinical skills, exam interpretation familiarity and staff experience in trauma length as potential factors that may prevent misdiagnosis.

Conclusion

The Ottawa ankle rules showed high sensitivity and represent an important tool when deciding radiograph necessity in foot and/or ankle sprains. However, this method showed high false positive rates.

Weight-bearing inability was the most important isolated item to predict fracture presence.

Subjective fracture perception presented high specificity.

The authors strongly recommend the Ottawa ankle rules complemented by subjective surgeon perception to prevent unnecessary radiation exposure and additional expenses.

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